

I believe Major Powell in his report, published or about to be published by Government, goes into the question of destruction of forests by fire very fully, and presents the case in a very strong light.

WEST CHESTER, CHESTER CO., PENNA., September 3, 1878.

DEAR MR. PRICE:—Since writing to you I find the following statement in a lecture by Prof. Gray of Cambridge, on "Forest Geography and Archæology" quoting from Professor Shaler of Kentucky—"Professor Shaler from his observations in the border land of Kentucky thinks that there are indications there of comparatively recent conversion of oak openings into prairie, and now since the burnings are over, of the re-conversion of prairie into woodland." The passage in the first part of the quotation refers to Shaler's opinion that fires have destroyed the forests there. This you know is in entire accordance with what is said on pages 276 and 277 of Michaux Travels, published in 1805 (Lambert's translation), of exactly the same region.

Sincerely yours,

J. T. ROTHROCK.

Professor Leo Lesquereaux has formed the opinion that the prairies have failed to produce trees because of a soil inimical to their growth. This theory appears to be successfully combatted by O. P. Hay in the *American Naturalist* for May 1878, p. 299. It is also contrary to many facts stated in "Sylviculture." The last page of that paper contains the conclusion of O. W. Wight, in his *Geology of Wisconsin*, who said, "Fire has killed the timber over wide areas, on which grass was growing, exhibiting before our eyes nature's simple method of reconverting woodland into prairie. The reverse process is just as simple. When prairies are no longer swept over by fire, timber springs up, reconverting prairie into woodland. Grass, with fire as an ally, can beat timber. *Timber can beat grass, when it has no fire to fight.*" We may also add that without fire to fight it can conquer stones and root itself beneath the rocks, and be anchored all the stronger. It is ever man that is the great destroyer, and he is competent to repair his own devastation.

Contributions from the University of Pa., No. XV. Preliminary notice on Chromometry, a new branch of quantitative analysis with the blowpipe.

BY PROFESSOR GEORGE AUG. KÖNIG, PH. D. WITH A PLATE.

(Read before the American Philosophical Society, Oct. 4, 1878.)

In a former paper presented to the Society (Proceedings Vol. XVI., January, 1877), I described a colorimetric estimation of titanium. Mention is made in that paper of the interference with accurate results by the pre-

sence of metals producing green glasses in the reducing flame, such as vanadium or chromium, the green being complementary with the red of titanium and thus destroying the latter. That method is purely colorimetric, as the determination depends on a comparison of color *intensity* with glass beads containing known quantities of titanium. But the mutual extinction of complementary colors led me, already at that date, to seek a way for the utilization of this principle, as expressed in the same paper: "I am now experimenting upon the feasibility of extinguishing the color of titanium by a graduated scale of green, etc." Finding, however, some serious practical obstacles, I allowed the subject to rest until the present summer, when perfect leisure favored a more successful pursuit.—I now place before the Society the result in a preliminary form, reserving for a future paper the details and the special determinations, as well as tables, for a number of the most important minerals and ores.—The new method of analysis I propose to name "chromometry," for I measure the *quality* as well as the quantity of certain colors, both isolated and when combined with other colors not their complementaries, these latter being the determinants. Thus, iron imparts to borax in the oxydizing flame a dark red-brown color while the bead is hot, which passes into pure yellow at the ordinary temperature of the air. Under the same conditions manganese produces a purplish-red glass, both together a brown glass in all shades from pure yellow to pure red, according to the relative quantities of the two metals. If this glass be looked at through a certain thickness of a transparent green medium, such as green glass—the red will have disappeared and a pure yellow will be seen; increasing the thickness of green medium ever so little, will cause a greenish yellow color to appear, whilst an equal reduction in the medium will cause a brownish-yellow tint. The human eye is much quicker to appreciate a change of shade, than a small change of intensity of color, as those well know, who are accustomed to the polarization of sugar. In this instance I designate the pure *yellow* as the *point of extinction*, while colorlessness or any other simple color may represent extinction in other cases.—Thus it will be understood that the new method *analyses* the colors, what colorimetry of liquids as heretofore applied does *not*, it involves another principle and should therefor be called by another name.—Chromometry seems to express the essentials of the method very well "a measuring of color" besides being a purely Greek compound noun, not Latin-Greek, as Colorimetry. The new principle of analysis by complementary colors is applicable to both liquid and solid transparent colored bodies, but I shall confine myself for the present to the solids exclusively.

In regard to their behavior towards borax and microcosmic salt—the metals are *chromatic* (imparting characteristic colors to these fluxes) or *achromatic* (imparting no color, or no characteristic color).—The chromatic series comprises: copper, nickel, cobalt, iron, uranium, chromium, vanadium, tungsten, titanium, manganese, molybdenum, niobium, ilmenium, neptunium. All of these metals fall within the capacity of chromometric

determination. Some of them are eminently chromatic as: Manganese cobalt, vanadium, titanium, and they are capable of very accurate determination. 0. ^{mgr.}01 of Mn.₂O₃, dissolved in 100 mgrs. of borax glass yields a distinct color, 0. ^{mgr.}1 a deep color, 0. ^{mgr.}2 nearly opaqueness. The range of greatest sensitiveness is between 0. ^{mgr.}05 and 0. ^{mgr.}10; the limit of uncertainty for my eye is 0. ^{mgr.}002 Mn.₂O₃.

Execution of the method.

1. *Preparation of the bead.* Before starting upon an analysis, I melt a number of borax beads weighing each about 90 mgrs. Some of these I crush in a steel mortar and keep the coarse powder on a watch glass for use. A number of platinum wires, weighing 100 mgrs. each, or a few tenths less, are likewise kept in readiness. They have at one end a circular loop (*l*) 0.1 inch in diameter. One of these wires (*w*), Fig. 1, I place on the pan of a delicate balance, which should indicate one twentieth of a milligram with precision, and at the same time rapidly. (Such balances are known as "Small size Assay balances and are manufactured in great perfection by the firm of Trömmner & Sons of Philadelphia.) The wire is readily tared by the milligram rider, as its weight is close to 100 mgrs.—A quantity (*s*) of 5 mgr. of the finely ground ore, or in many cases of determinative mineralogy a splinter of a mineral, is now weighed with the greatest care (the hand must rest exactly at zero) since an error here of $\pm 0. \sup{\text{mgr.}}{05}$ will produce either 99 percentum or 101 instead of 100. With some practice the error will not exceed ± 0.5 p. c. I remove now the 5 mgr. weight and replace it by one decigram. In the other pan I place one of the ready borax beads (*b*) and with the addition of pulverized borax glass (*p*) equilibrium is restored. The scale pans are made of platinum-foil. The one holding the flux and substance is placed on a holder (Plattner's cupel holder is very good) and brought beneath the blowpipe flame, so that the current of gases will not affect it, whilst the wire is inserted into its handle. The flame is a strong clean oxydizing one, produced best with hard oil and a mechanical blast (I find a small Catalan blast, made from a Wolf's bottle, very convenient and steady). Bringing the red hot loop of the wire down upon the borax bead causes this to adhere firmly, and after being melted picks up at once and without loss the smaller particles of the flux. In adding now the substance every precaution against mechanical loss must be taken. Should the substance contain volatile matter, care is particularly required, because if the mass of red hot flux be dipped into the midst of the fine powder the gases or vapors will generate so suddenly that a scattering must take place. But if the bead be approached to the margin of the small heap of powder and only a small quantity of it be taken up at a time, no loss will be sustained, as many experiments prove. From the smooth platinum surface of the pan every particle of substance can be collected. This operation consumes from 5 to 10 minutes according to the solubility of the metallic oxides. The bead is now allowed to cool and, still on the wire, replaced on the balance. Some

of the borax has been volatilized ; this with the volatilized constituents of the test substance, has now to be made up to 100 by addition of pulverized borax glass. After remelting in the oxidizing flame and cooling it will be found that the weight is still 100 mgr. Now I examine the bead. If too deeply colored or even opaque, I remelt it, throw it from the wire into a porcelain capsule, and crush it in the steel mortar. Of the powder I weigh off 5–10–20 etc. mgrs. according to the depth of coloration, and complement 100 mgrs. by a bead and pulverized glass, as before described. If after melting and cooling the color should be still too deep (in exceptional cases which will hereafter be described), a second dilution is effected in the same way. Of a substance containing 1.5 p. c. Mn_2O_3 —and no other coloring oxides—5 mgrs. will just give the convenient depth of color to the first bead and no dilution is here necessary. Again melted and thrown from the wire, the bead is ready for the next treatment. The quantity of colored glass adhering to the wire matters not, if it does not exceed 10 mgrs.

2. *Optical preparation of the bead.*—In developing this method it was soon found that with the spheroidal shape of the bead no constant results were obtainable. Acting as a lens it would concentrate the color if the radius of curvature were smaller, and dilute it if larger, besides it did not seem feasible to attach the bead in the chromometer so that the line of greatest thickness should exactly fall into the line of vision. After trying a number of contrivances unsuccessfully, I finally hit upon the simplest of all and one that proved entirely satisfactory. I take a platinum cylinder 0.09 inch high, 0.145 inch inner, and 0.167 inch outer diameter, hold it with a platinum tipped forceps into the flame until it is red hot, then press its circumference upon the bead, so that the latter adheres firmly. If now held again into the clear flame horizontally, bead downwards, until the glass becomes liquid and the cylinder red hot, capillary attraction will cause the glass to flow up into the cylinder, without any overflow on the outside of the platinum ring, and if turned properly while cooling, the glass will equally protrude with convex surface on either end of the ring, about 0.03 inch (fig. 3). After cooling, the bead, thus mounted, must appear entirely free of air bubbles. By the next step the protruding convexities are cut away, leaving two plane parallel faces and at the same time bringing about the standard thickness in the glass. Fig. 4 represents in natural size the serviceable contrivance which renders this operation both rapid and accurate.

A is a brass plate $\frac{1}{8}$ inch thick and 2 inches in diameter. A central perforation admits with easy friction the tube *B*, into one end of which the platinum cylinder fits. By slitting the tube has spring and holds the cylinder sufficiently tight. A shoulder in the tube prevents the cylinder from sliding in deeper when pressure is put on. The apparatus is placed upon a plane glass plate with some fine corundum (or emery) and water, the forefinger presses upon the knob of the tube, while thumb and middle finger grasp the neck of the plate and move the bead over the glass plate.

FIG. 6.
1/4 NAT. SIZE.

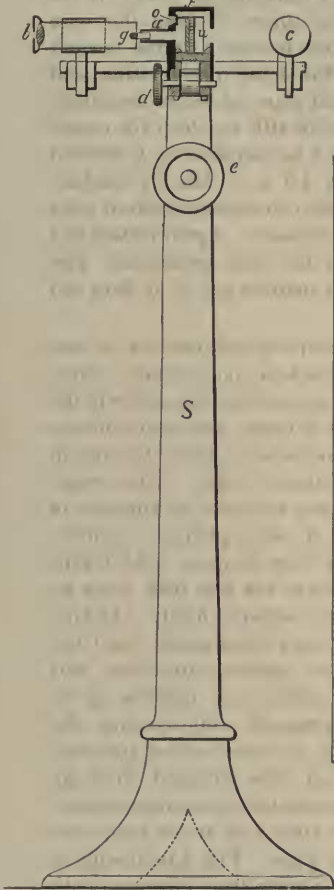


FIG. 1.
NAT. SIZE.

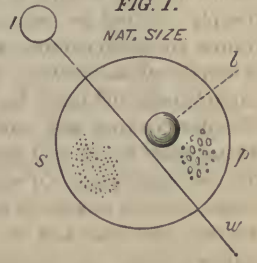


FIG. 7.
NAT. SIZE.

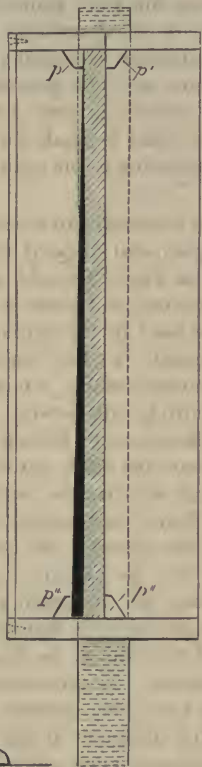


FIG. 3.



FIG. 5.
NAT. SIZE.

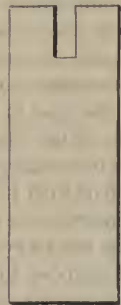


FIG. 4.
NAT. SIZE.



